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PATENT ABSTRACTS OF JAPAN

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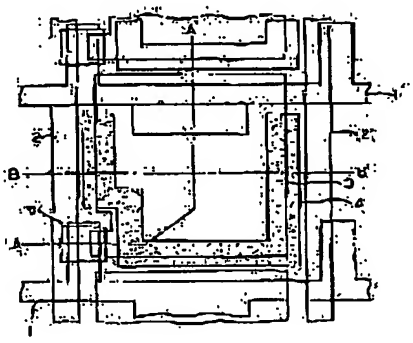
DOUMOTO CHIKAGE
NOMOTO MASAYUKI

(54) LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:
PURPOSE: To provide a wholly bright liquid crystal display device capable of improving the aperture rate of a pixel part by providing a pixel electrode even between the pixel electrode and scan signal wiring and preventing the reflection owing to the difference of a diffractive index and the lowering in transmissivity owing to that a thickness is increased by constituting the majority of the pixel electrode with a layer of transparent conductive film.
CONSTITUTION: This device is the liquid crystal display device constituted so that plural image signal wiring 2 and plural scan signal wiring 1 are provided intersectedly, and the pixel electrodes 3 and switching elements 5 supplying an image signal to the pixel electrodes 3 are provided on crossing parts between the image signal wiring 2 and the scan signal wiring 1 in matrix, and a liquid crystal material is held between the pixel electrodes 3 and counter electrodes provided opposite to the pixel electrodes 3, and belt-like second pixel electrodes 4 projecting to the scan signal wiring side and/or the image signal wiring side from the pixel electrodes 3 are provided on the rear surface side of the pixel electrodes 3.



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[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

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CLAIMS

[Claim(s)]
[Claim 1] It crosses and two or more picture signal wirings and two or more scanning signal wirings are prepared. to the intersection of this picture signal wiring and a scanning signal wiring In the LCD by which the liquid crystal material is held between the counterelectrodes which prepared the switching element which supplies a picture signal to a pixel electrode and this pixel electrode in the shape of a matrix, counter the aforementioned pixel electrode and this pixel electrode, and were prepared The LCD characterized by preparing the 2nd band-like pixel electrode jutted out over the aforementioned aforementioned scanning signal-wiring and/or picture signal wiring side rather than this pixel electrode in the rear-face side of the aforementioned pixel electrode.
[Claim 2] Lap capacity calcium between the aforementioned pixel electrode and the pixel electrode of the above 2nd is the liquid crystal capacity CLC2 between the pixel electrode of the above 2nd, and the aforementioned counterelectrode. LCD indicated to the claim 1 characterized by being more than twice.
[Claim 3] The LCD indicated to the claim 1 characterized by the aforementioned switching element being reverse stagger type TFT.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the LCD of an active matrix method which prepared the switching element in each pixel electrode about a LCD.
[0002]
[Description of the Prior Art] Since the LCD of an active matrix method has high contrast and is excellent in the multi-gradation display property compared with the simple matrix method, it serves as indispensable technique in electrochromatic display display. In the LCD of the active matrix method which used TFT as a switching element especially, quality of image equivalent to CRT came to be obtained.
[0003] Hereafter, the conventional LCD is explained, referring to a drawing. The enlarged view, the drawing 11 , and the drawing 12 of a pixel fraction of the former [drawing / 10] are an A-A'line and B-B' line cross section of drawing 10 , respectively. / of a LCD
[0004] The gate electrode of the TFT formed simultaneously with the scanning signal wiring which consists of a metal membrane, and this scanning signal wiring by 25 in drawing 10 , the drawing 11 , and the drawing 12 (G), The picture signal wiring with which 26 consists of a metal membrane or a transparent electric conduction layer, and the source (S) electrode of TFT 28, The pixel electrode which 27 becomes from a transparent electric conduction layer, and the drain (D) electrode of TFT, Top gate type TFT and 29 28 The semiconductor layer of TFT 28, The metal membrane for shading for 30 shading the light which carries out incidence to the channel section of TFT 28, For a counterelectrode, and 35 and 36, a transparent glass substrate and CLC are [31 / an insulator layer and 32 / the gate insulator layer of TFT 28, and 33 / a liquid crystal material and 34] the liquid crystal capacity between the pixel electrode 27 and the counterelectrode 34, and CS. It is the addition capacity between scanning signal-wiring 25' which adjoins the pixel electrode 27.
[0005] In the LCD of this active matrix method, top gate type TFT 28 is switched by the scanning signal supplied from the scanning signal wiring 25, a voltage is impressed to the liquid crystal material held between the pixel electrode 27 and the counterelectrode 34 by impressing the signal level of the picture signal wiring 26 to the pixel electrode 27 which is extension of a drain (D) electrode, and a picture image is displayed. Addition capacity CS It is the capacity for the charge hold for carrying out a fixed time hold of the voltage impressed to the liquid crystal material 33.
[0006] In the above LCDs, since pixel electrode 27' which adjoins the pixel electrode 27 was the layer of the same level inserted into the insulator layer 31 and the gate insulator layer 32 as shown in drawing 11 , spacing L1 sufficient among both needed to be formed, and, for this reason, the pixel electrode 27 could not be enlarged enough, but there was a problem that the numerical aperture of a pixel fraction fell as a result so that these both might not connect too hastily. In the especially small and high definition LCD, the influence was remarkable.
[0007] Moreover, since it was the layer of the same level by which the pixel electrode 27, the picture signal wiring 26, and 26' were also inserted into the insulator layer 31 and the gate insulator layer 32 as shown in drawing 12 , spacing L2 sufficient among both needed to be formed, and there was a problem that the numerical aperture of a pixel fraction fell also for this ground.
[0008] That is, in the conventional LCD, as shown in drawing 13 , the field which can penetrate the light in pixel electrode 27 fraction had only the field of the oblique-line fraction shown by P1, and the numerical aperture of a pixel fraction was a parvus thing.
[0009] In order to solve such a problem, these people In Japanese Patent Application No. 330785 [five to], as shown in drawing 14 , the drawing 15 , the drawing 16 , and the drawing 17 While a pixel electrode is constituted from an upper pixel electrode 43 and a lower layer pixel electrode 44 and the lower layer pixel electrode 44 is jutted out and formed in scanning signal-wiring 41 side and picture signal wiring 42, and 42' side rather than the upper pixel electrode 43 The LCD which formed the electrode for addition capacity 47 which consists of the scanning signal wiring 41 which consists of a metal membrane, and a transparent electric conduction layer was proposed. The insulator layer 48 which consists of a silicon nitride film, a tantalum oxide layer, etc. is made to have intervened between the upper pixel electrode 43 and the lower layer pixel electrode 44. The upper pixel electrode 43 and the lower layer pixel electrode 44 are formed by transparent electric conduction layers, such as ITO (indium oxide tin) and a tin oxide (SnO). In this case, since the upper pixel electrode 43 and the lower layer pixel electrode 44 have lapped in a big area through the gate insulator layer 48, it is the liquid crystal capacity

CLC2 between the lower layer pixel el...ode 44 and the counterelectrode 51. It compare...ld the vertical pixel electrode 43 and lap capacity calcium between 44 become large sharply, and, as a result, the lower layer pixel electrode 44 also comes to carry out the same work as the upper pixel electrode 43.
[0010] In addition, drawing 15 is [the B-B' line cross section of drawing 14 and the drawing 17 of the A-A' line cross section of drawing 14 and the drawing 16] C-C' line cross sections of drawing 14 .
[0011] Thus, if the lower layer pixel electrode 44 is jutted out and formed in scanning signal-wiring 41 and picture signal wiring 42, and 42' side while a pixel electrode is constituted from an upper pixel electrode 43 and a lower layer pixel electrode 44, as shown in drawing 18 , a pixel electrode can be extended to the field of not only the field of P1 but P2, P3, and P4, and the numerical aperture of a pixel fraction can be raised.
[0012] However, although the upper pixel electrode 43 and the lower layer pixel electrode 44 are formed for this conventional LCD by the transparent electric conduction layer, since this upper pixel electrode 43 and the lower layer pixel electrodes 44 overlap in most fields, in this lap fraction, the substantial thickness of a pixel electrode becomes thick. Moreover, if the upper pixel electrode 43 and the lower layer pixel electrode 44 are formed, light will penetrate two or more layers from which a refractive index is different, and reflex of the light in an interface fraction will occur. Consequently, in this conventional LCD, the permeability of light fell five to 10%, and there was a problem that the whole display became dark.
[0013]
[Objects of the Invention] The LCD concerning this invention is invented in view of the trouble of equipment such conventionally, and the numerical aperture of a pixel fraction is large and it aims at offering the bright LCD which the permeability of light moreover does not reduce.
[0014]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, in the LCD concerning this invention It crosses, two or more picture signal wirings and two or more scanning signal wirings are prepared, and it is the intersection of this picture signal wiring and a scanning signal wiring. The switching element which supplies a picture signal to a pixel electrode and this pixel electrode is prepared in the shape of a matrix. The aforementioned pixel electrode, The 2nd band-like pixel electrode jutted out rather than this pixel electrode in the LCD by which the liquid crystal material is held between the counterelectrodes which counter this pixel electrode and were prepared at the aforementioned aforementioned scanning signal-wiring and/or picture signal wiring side at the rear-face side of the aforementioned pixel electrode was prepared.
[0015]
[Function] As mentioned above, the light transmittance of almost all the fields of a pixel fraction improves, if the 2nd pixel electrode jutted out of this pixel electrode is prepared, while the numerical aperture of the pixel section will improve to the rear-face side of a pixel electrode, since it consists of the much more transparent electric conduction layer, it has them and they become a collectively bright LCD to it.
[0016]
[Example] Hereafter, the example of this invention is explained in detail based on an accompanying drawying. Drawing 1 is drawing showing one example of the LCD concerning this invention, drawing 2 is an A-A' line cross section of drawing 1 , and drawing 3 is a B-B' line cross section of drawing 1 . For the switching element to which a picture signal wiring and 3 grow into in a scanning signal wiring and 2, and the 2nd pixel electrode and 5 grow [1] from TFT in a pixel electrode and 4, and 6, as for a liquid crystal material and 8, in the drawing 1 or the drawing 3 , a counterelectrode, and 9 and 10 are [a protective coat and 7] transparent glass substrates.
[0017] Two or more scanning signal wirings 1 and picture signal wirings 2 are formed, respectively, and the pixel electrode 3 and the switching element 5 are formed in a part for each intersection of this scanning signal wiring 1 and the picture signal wiring 2.
[0018] A switching element 5 mainly consists of a drain electrode (D) formed succeeding the source electrode (S) pixel electrode 3 formed succeeding the gate electrode (G) gate insulator layer 11 continued and formed in the scanning signal wiring 1, the semiconductor layer 12 used as the channel section, and the picture signal wiring 2. A gate electrode (G) is located caudad and this switching element 5 is formed in the reverse stagger structure where a source electrode (S) and a drain electrode (D) are located up. Thus, if a switching element 5 is formed in reverse stagger structure, while the metal membrane for shading of the channel section of the transistor which was the need conventionally will become unnecessary, the electrode for addition capacity mentioned later can be simultaneously formed by the transparent electric conduction layer.
[0019] The scanning signal wiring 1 and a gate electrode (G) are formed by metal thin films, such as aluminum (aluminum) and a tantalum (Ta). The gate insulator layer 11 is formed by the silicon nitride (SiNx), the silicon oxide (SiO2), tantalum oxide (TaOx), etc. The semiconductor layer 12 is formed by the amorphous silicon layer etc.
[0020] The picture signal wiring 2, a source electrode (S), and a drain electrode (D) are formed by the cascade screen of metal membranes, such as aluminum (aluminum), titanium (Ti), and ********** (Mo), these metal membranes, and transparent electric conduction layers, such as ITO. The pixel electrode 3 and the 2nd pixel electrode 4 are formed by transparent electric conduction layers, such as ITO.
[0021] Addition capacity CS for holding the voltage impressed to the liquid crystal material 7 during a fixed period between scanning signal-wiring 1' which adjoins the pixel electrode 3 It is the liquid crystal capacity CLC1 between the pixel electrode 3 and the counterelectrode 8. It is the liquid crystal capacity CLC2 between the 2nd pixel electrode 4 and the counterelectrode 8. It laps between the pixel electrode 3 and the 2nd pixel electrode 4, and capacity calcium is formed, respectively.

[0022] In this LCD, it is switched by reverse stagger type TFT 5, and by impressing the signal level of the picture signal wiring 2 to the pixel electrode 3 which is extension of a drain electrode (D), a voltage is impressed to the liquid crystal material 7 held between the pixel electrode 3 and the 2nd pixel electrode 4, and the counterelectrode 11, and a picture image is displayed.
[0023] Moreover, through the insulator layer 11, the 2nd band-like pixel electrode 4 ******s to the scanning signal-wiring 1 and picture signal wiring 2 side, and is formed in the rear-face side of the pixel electrode 3. In this case, for the pixel electrode 3 and the 2nd pixel electrode 4, lap capacity calcium between the pixel electrode 3 and the 2nd pixel electrode 4 is the liquid crystal capacity CLC2 between the 2nd pixel electrode and a counterelectrode. It is desirable to form so that it may become more than twice. Thus, lap capacity calcium between the pixel electrode 3 and the 2nd pixel electrode 4 is the liquid crystal capacity CLC2 between the 2nd pixel electrode 4 and a counterelectrode about the 2nd pixel electrode 4. If it forms so that it may become more than twice, 2/3 or more voltages of the pixel electrode 3 will come to be impressed also to the 2nd pixel electrode 4, and the 2nd pixel electrode 4 will also come to carry out the same work as the pixel electrode 3.
[0024] In addition, even if it forms the 2nd band-like pixel electrode 4 only in a scanning signal-wiring side, the numerical aperture of a pixel fraction can be raised in the limitation.
[0025] Drawing 4 - view 6 is drawing showing other examples. this example -- the middle on scanning signal-wiring 1' of the pixel electrode 3 which adjoins an edge on the other hand -- until -- while it forms so that it may extend, the another side edge of the pixel electrode 3 is approached and established in the scanning signal wiring 1 Since the pixel electrode 3 and the scanning signal wiring 1 are the layers of the different level formed through an insulator layer 11, the another side edge of the pixel electrode 3 can be approached and established in the scanning signal wiring 1.
[0026] Moreover, in this example, rather than this pixel electrode 3, the 2nd band-like pixel electrode 4 is jutted out over the picture signal wiring 2 side, and is formed in the rear-face side of the pixel electrode 3.
[0027] also in this case, the 2nd pixel electrode 4 carries out the same work as the pixel electrode 3 -- as -- lap capacity calcium between the pixel electrode 3 and the 2nd pixel electrode 4 -- liquid crystal capacity CLC2 between the 2nd pixel electrode 4 and the counterelectrode 11 It forms so that it may become more than twice.
[0028] Thus, while ** which juts out the 2nd band-like pixel electrode 4 over picture signal wiring 2 and 2' side, and prepares it in the rear-face side of this pixel electrode 3 while the pixel electrode 3 is approached and formed in the scanning signal wiring 1 can also mention the numerical aperture of a pixel fraction, it can gather the light transmittance of a pixel fraction.
[0029] Drawing 7 - view 9 is drawing showing other examples. In this example, the 2nd band-like pixel electrode 4 is formed in the rear-face side of the pixel electrode 3 in the shape of a ** character. Thus, if the 2nd pixel electrode 4 is formed in the shape of a ** character, since a pixel electrode and the 2nd pixel electrodes 4 overlap over the comparatively large field by the side of the rear face of the pixel electrode 4, even if a part of 2nd pixel electrode 4 is disconnected, other fractions can be operated effectively.
[0030]
[Effect of the Invention] According to the LCD concerning this invention, as mentioned above, to the rear-face side of a pixel electrode From having prepared the 2nd band-like pixel electrode jutted out over the scanning signal-wiring and/or picture signal wiring side rather than this pixel electrode While a pixel electrode exists also between a pixel electrode and a scanning signal wiring, the area of a pixel electrode becomes large substantially and the numerical aperture of the pixel section improves Since most pixel electrodes consist of the much more transparent electric conduction layer, it can also prevent the reflex at the time of carrying out the laminating of two or more layers from which a refractive index is different, and a fall of the permeability of the light by thickness increasing, and serves as a collectively bright LCD.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing one example of the LCD concerning this invention.
[Drawing 2] It is the A-A' line cross section of drawing 1.
[Drawing 3] It is the B-B' line cross section of drawing 1.
[Drawing 4] It is drawing showing other examples of the LCD concerning this invention.
[Drawing 5] It is the A-A' line cross section of drawing 4.
[Drawing 6] It is the B-B' line cross section of drawing 4.
[Drawing 7] It is drawing showing the example of the others of the LCD concerning this invention.
[Drawing 8] It is the A-A' line cross section of drawing 7.
[Drawing 9] It is the B-B' line cross section of drawing 7.
[Drawing 10] It is the enlarged view of the pixel fraction of the conventional LCD.
[Drawing 11] It is the A-A' line cross section of drawing 10.
[Drawing 12] It is the B-B' line cross section of drawing 10.
[Drawing 13] It is drawing showing opening of the pixel fraction in the conventional LCD.
[Drawing 14] It is drawing showing the pixel fraction of other conventional LCDs.
[Drawing 15] It is the A-A' line cross section of drawing 15.
[Drawing 16] It is the B-B' line cross section of drawing 15.
[Drawing 17] It is the C-C' line cross section of drawing 15.
[Drawing 18] It is drawing showing the numerical aperture of the pixel fraction in other conventional LCDs.
[Description of Notations]
1 [... A pixel electrode, 4 / ... The 2nd pixel electrode, 5 / ... A switching element, 6 / ... A protective coat, 7 / ... A liquid crystal material, 8 / ... Counterelectrode] ... A scanning signal wiring, 2 ... A picture signal wiring, 3

[Translation done.]

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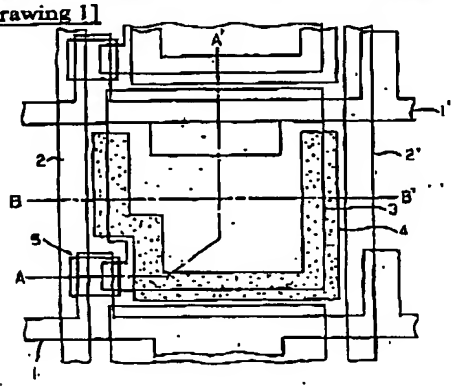
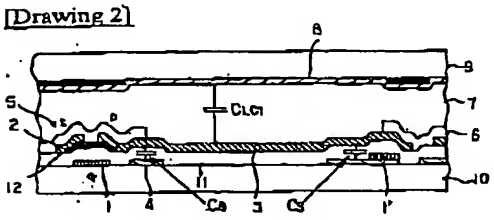
DRAWINGS

[Drawing 1]



[Drawing 2]



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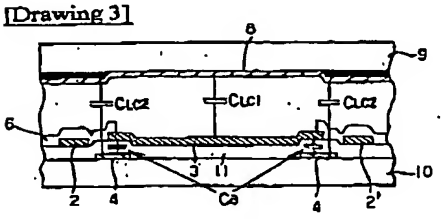
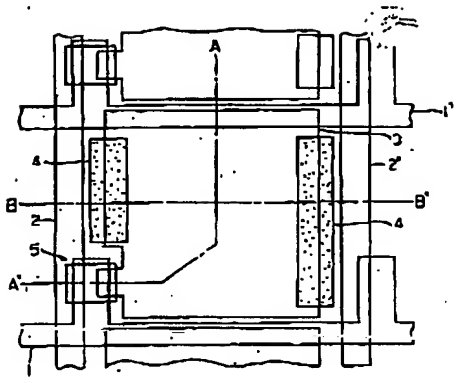


[Drawing 4]



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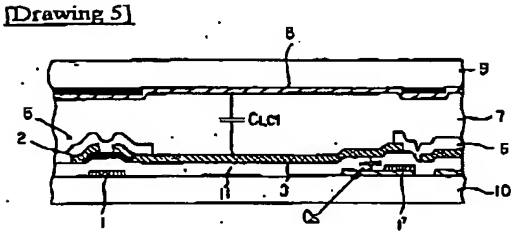

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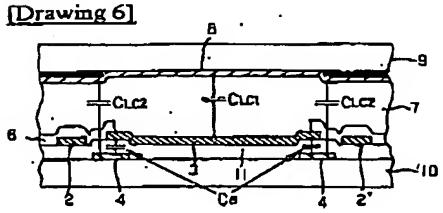

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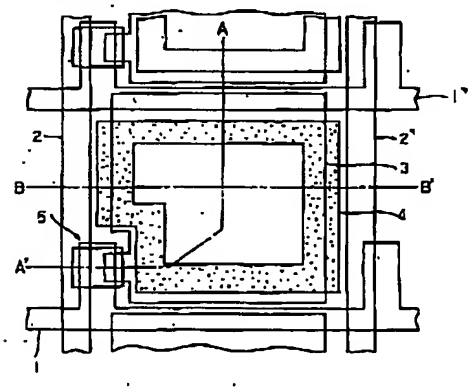

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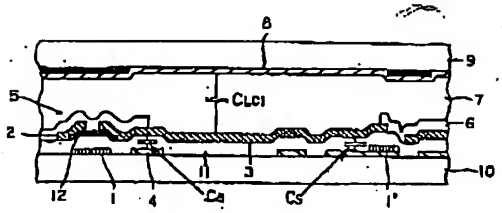

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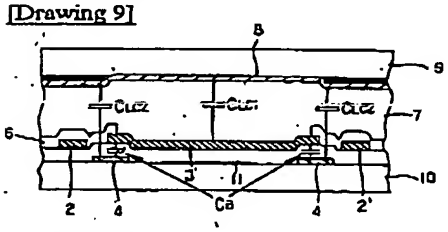
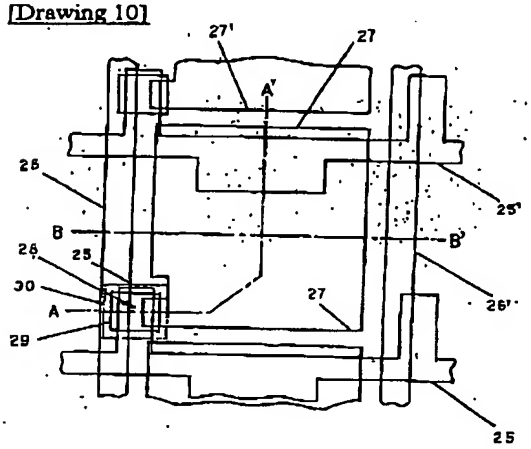


[Drawing 10]



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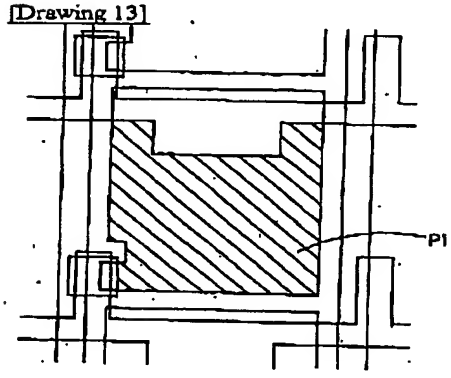
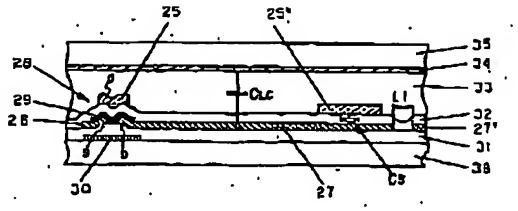


[Drawing 11]



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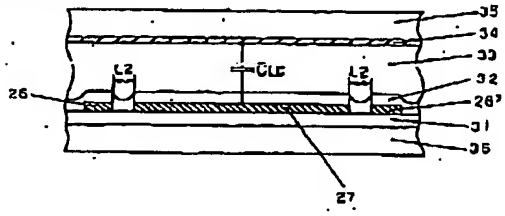

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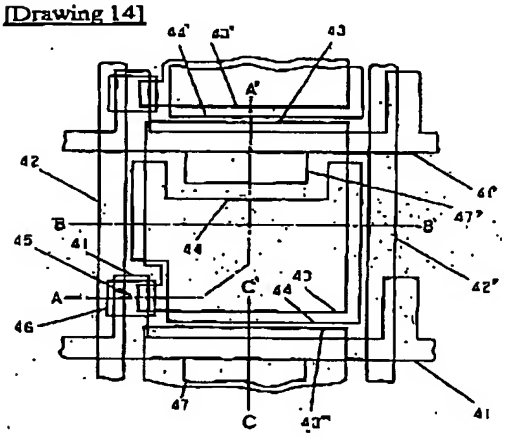

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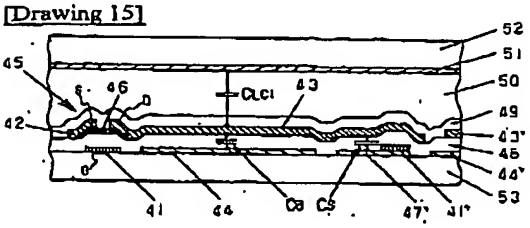

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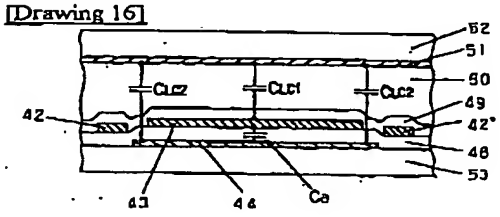

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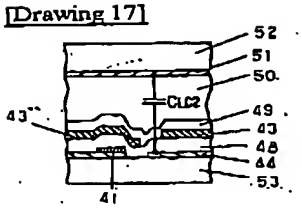
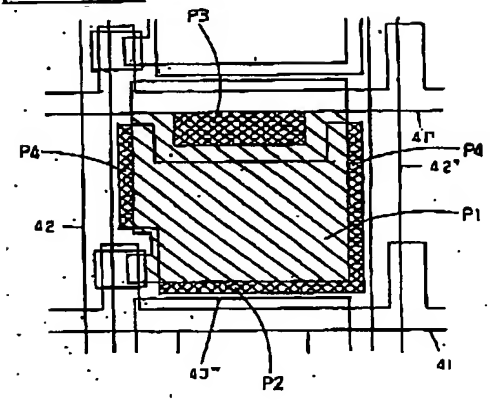


[Drawing 18]



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LIQUID CRYSTAL DISPLAY DEVICE

Patent Number: JP9015621

Publication date: 1997-01-17

Inventor(s): MATSUO SHIGEKI; DOUMOTO CHIKAGE; NOMOTO MASAYUKI

Applicant(s):: KYOCERA CORP

Requested Patent: JP9015621

Application Number: JP19950163367 19950629

Priority Number(s):

IPC Classification: G02F1/1343 ; G02F1/136

EC Classification:

Equivalents:

Abstract

PURPOSE: To provide a wholly bright liquid crystal display device capable of improving the aperture rate of a pixel part by providing a pixel electrode even between the pixel electrode and scan signal wiring and preventing the reflection owing to the difference of a diffractive index and the lowering in transmissivity owing to that a thickness is increased by constituting the majority of the pixel electrode with a layer of transparent conductive film.

CONSTITUTION: This device is the liquid crystal display device constituted so that plural image signal wiring 2 and plural scan signal wiring 1 are provided intersectedly, and the pixel electrodes 3 and switching elements 5 supplying an image signal to the pixel electrodes 3 are provided on crossing parts between the image signal wiring 2 and the scan signal wiring 1 in matrix, and a liquid crystal material is held between the pixel electrodes 3 and counter electrodes provided opposite to the pixel electrodes 3, and belt-like second pixel electrodes 4 projecting to the scan signal wiring side and/or the image signal wiring side from the pixel electrodes 3 are provided on the rear surface side of the pixel electrodes 3.

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(43)公開日　平成９年(1997)１月17日

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	1/136	５００			1/136	５００	

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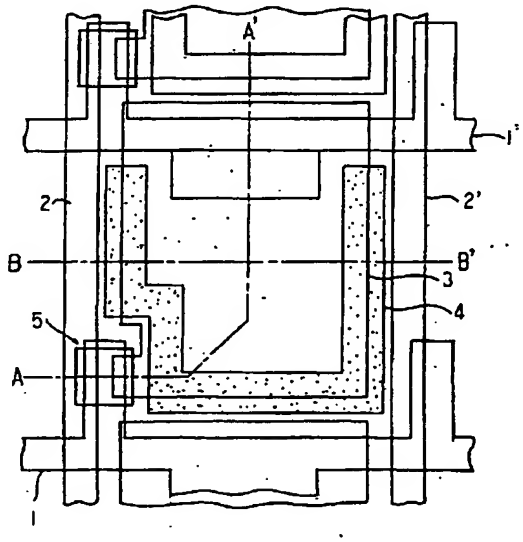
(54)【発明の名称】　液晶表示装置

(57)【要約】

【構成】　複数の画像信号配線と、複数の走査信号配線とを交差して設け、この画像信号配線と走査信号配線との交差部に、画素電極とこの画素電極に画像信号を供給するスイッチング素子とをマトリックス状に設け、上記画素電極とこの画素電極に対向して設けられた対向電極との間に液晶材料が保持されている液晶表示装置であって、上記画素電極の裏面側に、この画素電極よりも走査信号配線側及び／又は画像信号配線側に張り出した帯状の第２の画素電極を設けた。

【効果】　画素電極と走査信号配線との間にも画素電極が存在することにより、画素部の開口率が向上すると共に、画素電極の大部分は一層の透明導電膜で構成されることから、屈折率の相違による反射や、厚みが増すことによる透過率の低下を防止でき、全体として明るい液晶表示装置となる。



【特許請求の範囲】
【請求項1】　複数の画像信号配線と、複数の走査信号配線とを交差して設け、この画像信号配線と走査信号配線との交差部に、画素電極とこの画素電極に画像信号を供給するスイッチング素子とをマトリックス状に設け、前記画素電極とこの画素電極に対向して設けられた対向電極との間に液晶材料が保持されている液晶表示装置において、前記画素電極の裏面側に、この画素電極よりも前記走査信号配線側及び／又は前記画像信号配線側に張り出した帯状の第2の画素電極を設けたことを特徴とする液晶表示装置。
【請求項2】　前記画素電極と前記第2の画素電極との間の重なり容量Caが、前記第2の画素電極と前記対向電極との間の液晶容量C_{LC2}の2倍以上であることを特徴とする請求項1に記載した液晶表示装置。
【請求項3】　前記スイッチング素子が逆スタガ型薄膜トランジスタであることを特徴とする請求項1に記載した液晶表示装置。
【発明の詳細な説明】
【0001】
【産業上の利用分野】本発明は液晶表示装置に関し、特に各画素電極にスイッチング素子を設けたアクティブマトリックス方式の液晶表示装置に関する。
【0002】
【従来の技術及び発明が解決しようとする課題】アクティブマトリックス方式の液晶表示装置は、単純マトリックス方式と比べてコントラストが高く、多階調表示特性に優れているため、カラー液晶表示装置では欠かせない技術となっている。特に、スイッチング素子として薄膜トランジスタを使用したアクティブマトリックス方式の液晶表示装置では、CRTと同等の画質が得られるようになった。
【0003】以下、図面を参照しながら、従来の液晶表示装置を説明する。図10は、従来の液晶表示装置の画素部分の拡大図、図11及び図12はそれぞれ図10のA－A'線及びB－B'線断面図である。
【0004】図10、図11及び図12において、25は金属膜よりなる走査信号配線及びこの走査信号配線と同時に形成される薄膜トランジスタのゲート電極（G）、26は金属膜や透明導電膜よりなる画像信号配線および薄膜トランジスタ28のソース（S）電極、27は透明導電膜よりなる画素電極及び薄膜トランジスタのドレイン（D）電極、28はトップゲート型の薄膜トランジスタ、29は薄膜トランジスタ28の半導体膜、30は薄膜トランジスタ28のチャネル部に入射する光を遮光するための遮光用金属膜、31は絶縁膜、32は薄膜トランジスタ28のゲート絶縁膜、33は液晶材料、34は対向電極、35、36は透明ガラス基板、C_{LC}は画素電極27と対向電極34との間の液晶容量、C_Sは画素電極27と隣接する走査信号配線25'との間の付加容量である。
【0005】このアクティブマトリックス方式の液晶表示装置では、走査信号配線25から供給される走査信号によってトップゲート型の薄膜トランジスタ28がスイッチングされ、画像信号配線26の信号電圧をドレイン（D）電極の延長である画素電極27に印加することにより、画素電極27と対向電極34との間に保持された液晶材料に電圧を印加して、画像の表示を行うものである。付加容量C_Sは液晶材料33に印加する電圧を一定時間保持するための電荷保持用の容量である。
【0006】上述のような液晶表示装置では、図11に示すように、画素電極27と隣接する画素電極27'が絶縁膜31とゲート絶縁膜32にはさまれた同じレベルの層であるため、この両者が短絡しないように、両者間に充分な間隔L1を設ける必要があり、このため画素電極27を充分大きくすることができず、その結果画素部分の開口率が低下するという問題があった。特に、小型・高精細の液晶表示装置では、その影響が顕著であった。
【0007】また、図12に示すように、画素電極27と画像信号配線26、26'も絶縁膜31とゲート絶縁膜32にはさまれた同じレベルの層であるため、両者間に充分な間隔L2を設ける必要があり、この理由によっても画素部分の開口率が低下するという問題があった。
【0008】すなわち、従来の液晶表示装置では、図13に示すように、画素電極27部分における光の透過可能な領域はP1で示す斜線部分の領域しかなく、画素部分の開口率が小さいものであった。
【0009】このような問題を解決するために、本出願人は、特願平5－330785号において、図14、図15、図16及び図17に示すように、画素電極を上層画素電極43と下層画素電極44で構成し、下層画素電極44を上層画素電極43よりも走査信号配線41側及び画像信号配線42、42'側に張り出して形成すると共に、金属膜から成る走査信号配線41と透明導電膜から成る付加容量用電極47を設けた液晶表示装置を提案した。上層画素電極43と下層画素電極44との間には、窒化シリコン膜や酸化タンタル膜などから成る絶縁膜48を介在させてある。上層画素電極43及び下層画素電極44は、例えばITO（酸化インジウム錫）や酸化錫（SnO）などの透明導電膜で形成される。この場合、上層画素電極43と下層画素電極44がゲート絶縁膜48を介して大きな面積で重なっているため、下層画素電極44と対向電極51との間の液晶容量C_{LC2}に比べて上下画素電極43、44間の重なり容量Caが大幅に大きくなり、その結果、下層画素電極44も上層画素電極43と同じ働きをするようになる。
【0010】なお、図15は図14のA－A'線断面図、図16は図14のB－B'線断面図、図17は図14のC－C'線断面図である。

【００１１】このように、画素電極を上層画素電極４３と下層画素電極４４で構成すると共に、下層画素電極４４を走査信号配線４１及び画像信号配線４２、４２'側に張り出して形成すると、図１８に示すように、画素電極をＰ１の領域のみならず、Ｐ２、Ｐ３及びＰ４の領域まで広げることができ、画素部分の開口率を向上させることができる。

【００１２】ところが、この従来の液晶表示装置は、上層画素電極４３と下層画素電極４４は透明導電膜で形成されるものの、この上層画素電極４３と下層画素電極４４は大部分の領域で重なりあっていることから、この重なり部分では画素電極の実質的な膜厚は厚くなる。また、上層画素電極４３と下層画素電極４４を設けると、屈折率が異なる複数の層を光が透過することになり、界面部分での光の反射が発生する。その結果、この従来の液晶表示装置では、光の透過率が５～１０％低下し、表示装置全体が暗くなるという問題があった。

【００１３】

【発明の目的】本発明に係る液晶表示装置は、このような従来装置の問題点に鑑みて発明されたものであり、画素部分の開口率が大きく、しかも光の透過率が低減することのない明るい液晶表示装置を提供することを目的とする。

【００１４】

【課題を解決するための手段】上記目的を達成するために、本発明に係る液晶表示装置では、複数の画像信号配線と、複数の走査信号配線を交差して設け、この画像信号配線と走査信号配線との交差部に　画素電極とこの画素電極に画像信号を供給するスイッチング素子とをマトリックス状に設け、前記画素電極と、この画素電極に対向して設けられた対向電極との間に液晶材料が保持されている液晶表示装置において、前記画素電極の裏面側に、この画素電極よりも前記走査信号配線側及び／又は前記画像信号配線側に張り出した帯状の第２の画素電極を設けた。

【００１５】

【作用】上記のように、画素電極の裏面側に、この画素電極から張り出した第２の画素電極を設けると、画素部の開口率が向上すると共に、画素部分の殆どの領域は一層の透明導電膜で構成されることから、光透過率が向上し、もって全体として明るい液晶表示装置になる。

【００１６】

【実施例】以下、本発明の実施例を添付図面に基づき詳細に説明する。図１は、本発明に係る液晶表示装置の一実施例を示す図であり、図２は図１のＡ－Ａ'線断面図、図３は図１のＢ－Ｂ'線断面図である。図１ないし図３において、１は走査信号配線、２は画像信号配線、３は画素電極、４は第２の画素電極、５は薄膜トランジスタから成るスイッチング素子、６は保護膜、７は液晶材料、８は対向電極、９、１０は透明ガラス基板である。

【００１７】走査信号配線１と画像信号配線２は、それぞれ複数設けられており、この走査信号配線１と画像信号配線２の各交差部分に画素電極３およびスイッチング素子５が設けられている。

【００１８】スイッチング素子５は、走査信号配線１に連続して形成されたゲート電極（Ｇ）、ゲート絶縁膜１１、チャネル部となる半導体膜１２、画像信号配線２に連続して形成されたソース電極（Ｓ）、画素電極３に連続して形成されたドレイン電極（Ｄ）で主として構成される。このスイッチング素子５は、ゲート電極（Ｇ）が下方に位置し、ソース電極（Ｓ）及びドレイン電極（Ｄ）が上方に位置する逆スタガ構造に形成される。このようにスイッチング素子５を逆スタガ構造に形成すると、従来必要であったトランジスタのチャネル部の遮光用金属膜が不要になると共に、後述する付加容量用電極を透明導電膜で同時に形成できるようになる。

【００１９】走査信号配線１およびゲート電極（Ｇ）は、アルミニウム（Ａｌ）やタンタル（Ｔａ）などの金属薄膜で形成される。ゲート絶縁膜１１は、窒化シリコン（SiN_x）、酸化シリコン（SiO_2）、酸化タンタル（TaO_x）などで形成される。半導体膜１２はアモルファスシリコン膜などで形成される。

【００２０】画像信号配線２、ソース電極（Ｓ）及びドレイン電極（Ｄ）は、アルミニウム（Ａｌ）、チタン（Ｔｉ）、モブリブデン（Ｍｏ）などの金属膜やこれら金属膜とＩＴＯなどの透明導電膜との積層膜で形成される。画素電極３および第２の画素電極４はＩＴＯなどの透明導電膜で形成される。

【００２１】画素電極３と隣接する走査信号配線１'との間で、液晶材料７に印加する電圧を一定期間保持するための付加容量C_Sが、画素電極３と対向電極８との間で液晶容量C_{LC1}が、第２の画素電極４と対向電極８との間で液晶容量C_{LC2}が、画素電極３と第２の画素電極４との間で重なり容量Ｃａがそれぞれ形成される。

【００２２】この液晶表示装置では、逆スタガ型の薄膜トランジスタ５によりスイッチングされ、画像信号配線２の信号電圧をドレイン電極（Ｄ）の延長である画素電極３に印加することにより、画素電極３及び第２の画素電極４と対向電極１１との間に保持された液晶材料７に電圧を印加して画像の表示を行う。

【００２３】また、画素電極３の裏面側に、絶縁膜１１を介して帯状の第２の画素電極４が走査信号配線１及び画像信号配線２側に張り出して形成されている。この場合、画素電極３と第２の画素電極４は、画素電極３と第２の画素電極４との間の重なり容量Ｃａが第２の画素電極と対向電極との間の液晶容量C_{LC2}の２倍以上となるように形成することが望ましい。このように第２の画素電極４を画素電極３と第２の画素電極４との間の重なり容量Ｃａが第２の画素電極４と対向電極との間の液晶容

量C_{LC2}の2倍以上となるように形成すると、第2の画素電極4にも画素電極3の2／3以上の電圧が印加されるようになり、第2の画素電極4も画素電極3と同じ働きをするようになる。

【0024】なお、帯状の第2の画素電極4を走査信号配線側のみに設けても、その限りにおいて、画素部分の開口率を向上させることができる。

【0025】図4～図6は、他の実施例を示す図である。この実施例では、画素電極3の一方端を隣接する走査信号配線1'上の途中まで延在するように形成すると共に、画素電極3の他方端を走査信号配線1に近接して設けている。画素電極3と走査信号配線1は絶縁膜11を介して形成される異なるレベルの層であるため、画素電極3の他方端は走査信号配線1に近接して設けることができる。

【0026】また、この実施例では、帯状の第2の画素電極4を画素電極3の裏面側に、この画素電極3よりも画像信号配線2側に張り出して形成している。

【0027】この場合も、第2の画素電極4が画素電極3と同じ働きをするように、画素電極3と第2の画素電極4との間の重なり容量Caを第2の画素電極4と対向電極11との間の液晶容量C_{LC2}の2倍以上となるように形成する。

【0028】このように、画素電極3を走査信号配線1に近接して設けると共に、この画素電極3の裏面側に帯状の第2の画素電極4を画像信号配線2、2'側に張り出して設けるても、画素部分の開口率を挙げることができると共に、画素部分の光透過率を上げることができる。

【0029】図7～図9は、その他の実施例を示す図である。この実施例では画素電極3の裏面側に帯状の第2の画素電極4をロ字状に設けている。このように、第2の画素電極4をロ字状に設けると、画素電極4の裏面側の比較的広い領域にわたって画素電極と第2の画素電極4が重なり合うことから、第2の画素電極4の一部が断線しても、その他の部分は有効に機能させることができる。

【0030】

【発明の効果】以上のように、本発明に係る液晶表示装置によれば、画素電極の裏面側に、この画素電極よりも走査信号配線側及び／又は画像信号配線側に張り出した帯状の第2の画素電極を設けたことから、画素電極と走査信号配線との間にも画素電極が存在し、実質的に画素電極の面積が広くなり、画素部の開口率が向上すると共に、画素電極の大部分は一層の透明導電膜で構成されることから、屈折率が相違する複数層を積層した場合の反射や、厚みが増すことによる光の透過率の低下も防止でき、全体として明るい液晶表示装置となる。

【図面の簡単な説明】

【図1】本発明に係る液晶表示装置の一実施例を示す図である。

【図2】図1のA－A'線断面図である。

【図3】図1のB－B'線断面図である。

【図4】本発明に係る液晶表示装置の他の実施例を示す図である。

【図5】図4のA－A'線断面図である。

【図6】図4のB－B'線断面図である。

【図7】本発明に係る液晶表示装置のその他の実施例を示す図である。

【図8】図7のA－A'線断面図である。

【図9】図7のB－B'線断面図である。

【図10】従来の液晶表示装置の画素部分の拡大図である。

【図11】図10のA－A'線断面図である。

【図12】図10のB－B'線断面図である。

【図13】従来の液晶表示装置における画素部分の開口部を示す図である。

【図14】従来の他の液晶表示装置の画素部分を示す図である。

【図15】図15のA－A'線断面図である

【図16】図15のB－B'線断面図である。

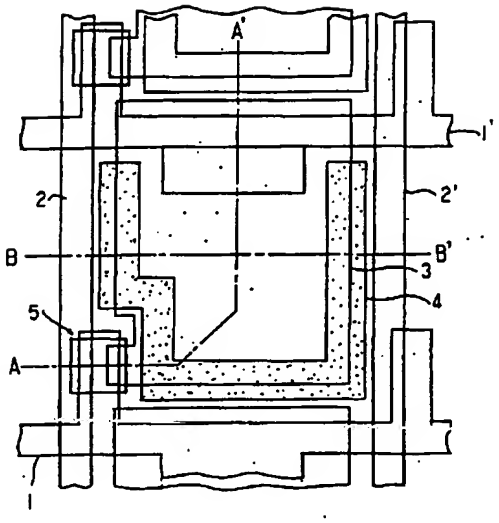
【図17】図15のC－C'線断面図である。

【図18】従来の他の液晶表示装置における画素部分の開口率を示す図である。

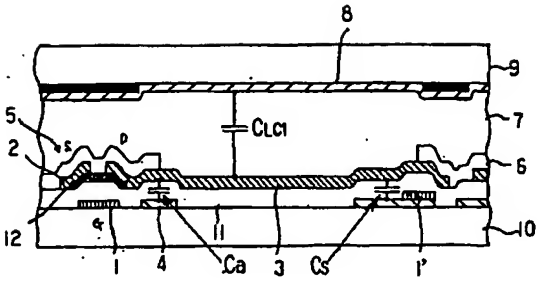
【符号の説明】

1・・・走査信号配線、2・・・画像信号配線、3・・・画素電極、4・・・第2の画素電極、5・・・スイッチング素子、6・・・保護膜、7・・・液晶材料、8・・・対向電極

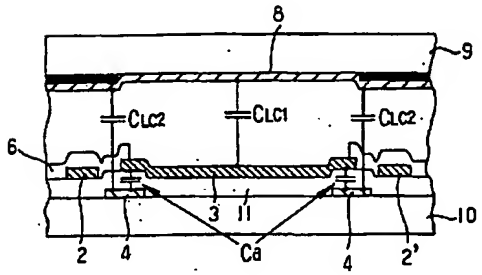
【図1】



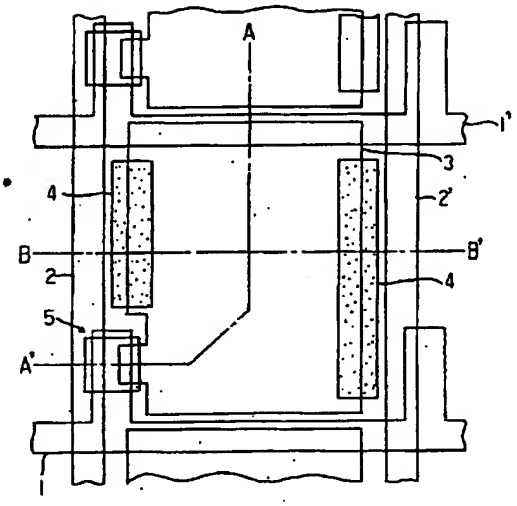
【図2】



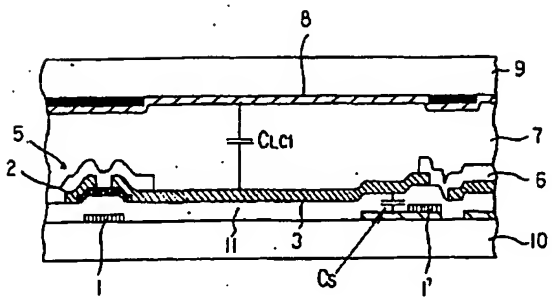
【図3】



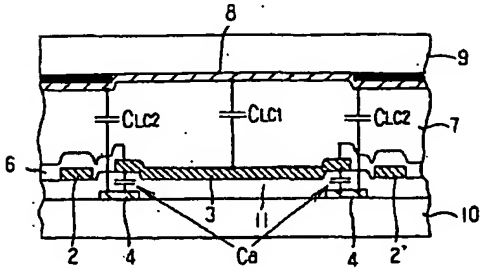
【図4】



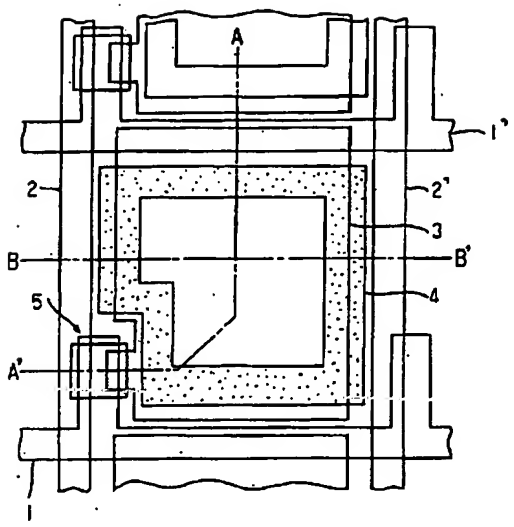
【図5】



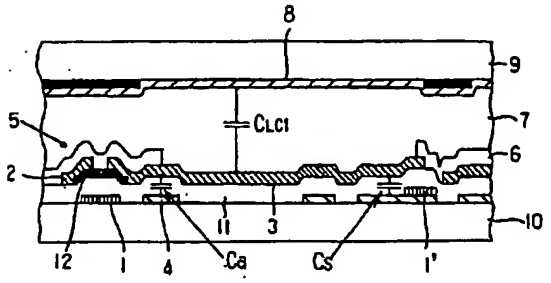
【図6】



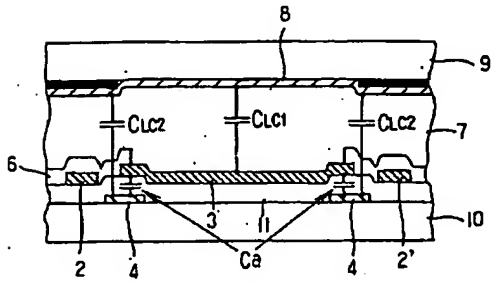
【図7】



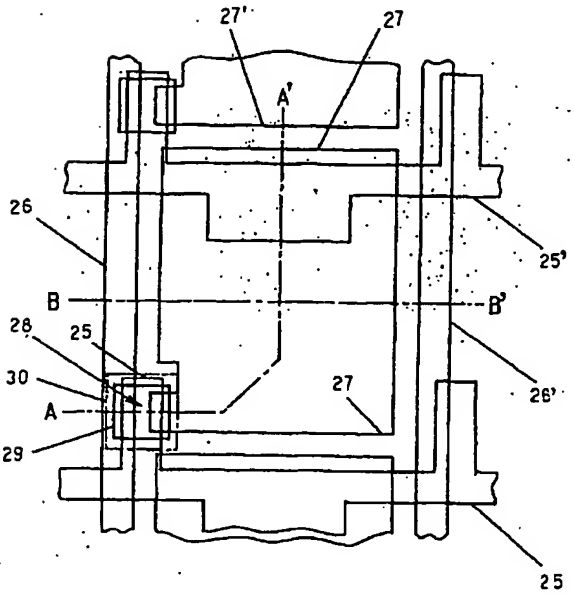
【図8】



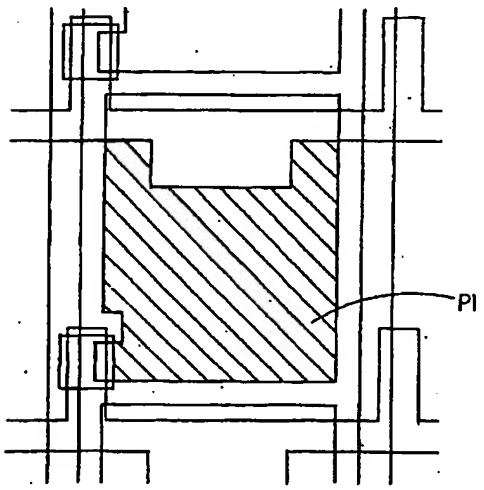
【図9】



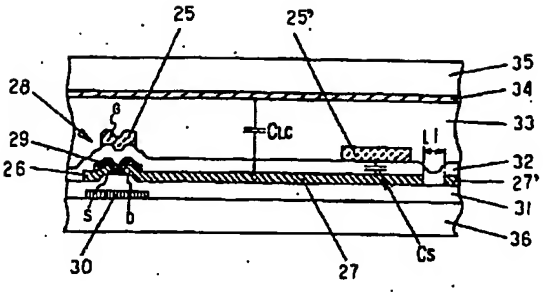
【図10】



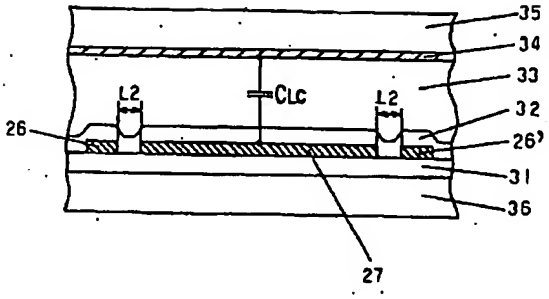
【図13】



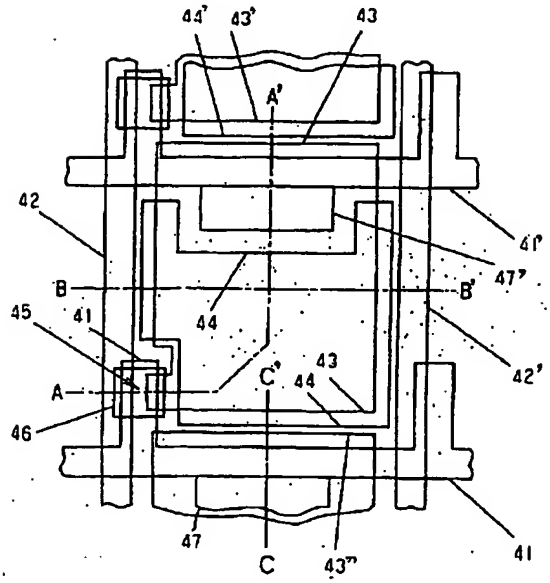
【図11】



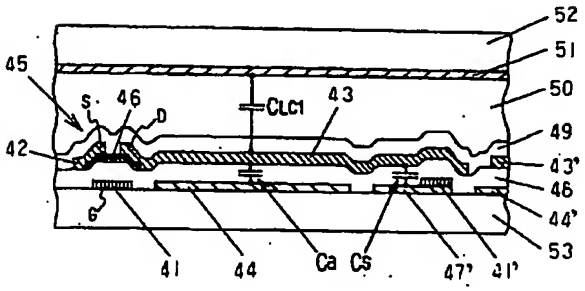
【図12】



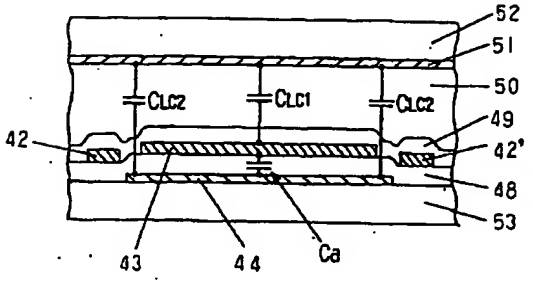
【図14】



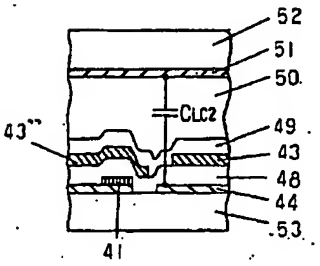
【図15】



【図16】



【図17】



【図18】